Question3

Solution :

First, put each apple as leaves of a binary tree and compare each pair of apples' weight and then push the heavier apple to the parent position and leave the original position of the heavier apple as empty. Then proceed in such way until we reach the root of the tree, the apple at root is the heaviest apple.

Secondly, pick out all of the apples which lost in comparison with the heaviest apple and do the same thing to build a binary tree. we can get the second heaviest apple at the root position.

Proof :

We need to do #leaves – 1 times to build the first binary tree and to find the heaviest apple, it' s 1023 times. Then the number of leaves of the second binary tree is $log_2^{1024} = 10$, so we need to do 9 times to build the second binary tree and find the second heaviest apple. So we can find the heaviest and the second heaviest apple while making at most 1032 weighings.